

# WATERSHED

## Science & Engineering

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## Memorandum

**To:** Chehalis River Basin Flood Authority  
**From:** Larry Karpack, WATERSHED Science & Engineering (WSE)  
**Date:** 1/17/2012  
**Re:** **Proposed Additions to Detailed Work Plan**

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Task 6 of the “Detailed Work Plan” for the Lower Chehalis River Hydraulic Model Development Project includes an optional allowance to refine hydraulic modeling of tributaries to the Chehalis River, with highest priority given to the Black, Satsop, Skookumchuck and Newaukum Rivers. The intent of this task was to allow modeling and analysis of tributary systems as necessary to support flood relief planning and downstream impact analyses. The task envisioned survey data collection, hydrologic analysis, and/or hydraulic modeling and analysis.

The City of Bucoda and Thurston County have identified specific flooding problems along the Skookumchuck River at Bucoda. Based on observations during past events they believe that the flooding in Bucoda is caused or exacerbated by hydraulic constrictions at the BNSF railroad trestle and may also be impacted by a levee. The following tasks are recommended to update and refine the existing hydraulic model of the Skookumchuck River in order to investigate potential alternatives for flood damage reduction.

**Task a - Obtain new channel survey data for the Skookumchuck River in the vicinity of Bucoda (RM 9.8 -12)** - The Corps Twin Cities hydraulic model includes a limited number of cross sections in this reach based on the 1989 Corps model, with two additional channel cross sections (at the railroad trestle, RM9.8, and in-channel at RM 11.92) based on the Corps survey completed by Minister Glaeser in 2001. After 20 years, the bulk of this data is likely out of date with current reach conditions, and a finer resolution through the town of Bucoda is required to adequately investigate hydraulic impacts of flood reduction alternatives. Given these facts, additional survey data collection to support model refinement for this reach (Task b) is needed.

Survey data collection will be conducted by PGS.

**Projected Sub-Task Completion Date:** February 15, 2012.

**Sub-Task Budget:** \$6,300

**Task b - Refine model of Skookumchuck River** - This reach is in the Twin Cities hydraulic model and additional model development for this reach is not currently part of the Corps GI study contract. Past modeling work by the Corps and/or FEMA did not include georeferencing or otherwise cleaning up the model above RM 6.4. This task entails georeferencing the existing Skookumchuck hydraulic model (from RM 6.42 to 21.77) and re-cutting the channel overbanks

throughout the model using 2002 PSLC LiDAR (or more recent LiDAR data if available). The model will then be refined in the vicinity of Bucoda (RM 9.8 - 12) using the cross section data described in Task a. Some level of model validation or calibration will be conducted; however, the validation effort is not expected to be significant.

The updated model will be used to evaluate the potential impacts of bridge and/or levee modification on flooding and storage in Bucoda and downstream.

Watershed Science & Engineering will be primarily responsible for this sub-task

***Projected Sub-Task Completion Date:*** March 1, 2012.

***Sub-Task Budget:*** \$15,500.00

Lewis County has indicated that additional hydraulic analysis of the Newaukum River would be beneficial to their flood damage reduction planning efforts. The main stem of the Newaukum River (downstream of the North Fork confluence, approximately 10.6 river miles) was last modeled by the Corps of Engineers for FEMA in 2006. However, the model developed for that study was not georeferenced (i.e. tied in to topographic mapping). Further, only a portion of the 2006 Newaukum River model was incorporated into the Twin Cities model completed by NHC for FEMA in 2010. The following task is recommended to update and incorporate the existing hydraulic model of the Newaukum River into the Chehalis River model being developed for this study by WSE and WEST.

**Task c - Refine and incorporate model of Newaukum River** – NHC developed and delivered to the Corps of Engineers in 2001 an HEC-RAS model of the Newaukum River, using data from various sources but primarily taken from a UNET model developed in the 1990s by PIE. This model covers the reach from the confluence with the Chehalis River upstream as far as the North Fork Newaukum River. WSE will use this model and, if available, cross-section layouts from the Corps of Engineers or from NHC to georeference and re-cut cross sections using 2002 PSLC LiDAR. Some cross-section locations may need to be estimated, using river mile stationing and reach lengths, with re-cut overbanks possibly following different (though hydraulically appropriate) alignments. Channel data from the existing model cross sections are from varied sources, including 1998 surveys by the Corps of Engineers, 1997 surveys by NHC, and older HEC-2 modeling. These cross-sections will be retained – no new survey is proposed for this task. Some level of model validation or calibration will be conducted; however, the validation effort is not expected to be significant.

Watershed Science & Engineering will be primarily responsible for this sub-task

***Projected Sub-Task Completion Date:*** March 1, 2012.

***Sub-Task Budget:*** \$5,200.00

The lower Satsop River, from just upstream of the SR 12 Highway Bridge to its mouth is included as a branch in the lower Chehalis River hydraulic model being developed for the Flood Authority. Cross sections on the Satsop River were field surveyed about 10 years ago as part of a Corps of Engineers floodplain restoration project. Review of aerial photographs shows that there has been significant lateral movement of the Satsop River channel since the previous

surveys were obtained. It is unclear if there has also been any significant vertical change in the channel (aggradation or degradation). Gray's Harbor County has indicated that a potential future project on the Satsop River would make use of the Lower Chehalis River hydraulic model. As such, it is important to understand if changes in the Satsop River channel since the earlier Corps project would affect the accuracy of that model. The following tasks are recommended to evaluate changes in the Satsop River channel geometry and determine if additional refinement of the model is necessary.

**Task d - Obtain new channel survey data for the Satsop River downstream of SR 12 (RM 0.0 - 2.0)** – There are approximately 20 cross sections in the HEC-RAS model of the main stem Satsop River in the reach downstream of SR 12. The in-channel portion of each of these cross sections (from vegetation line to vegetation line) will field surveyed. Depending on the flows at the time of the survey this will require ground survey in addition to bathymetric surveys. Survey data will be delivered in X-Y-Z coordinate format for use in Task e. Note that the cross sections on the overflow reach of the Satsop (Station 0.00 to 0.71) and the cross sections on the Chehalis River (Sections 19.89 to 20.40) will not be included in this resurvey. The cross sections on the main stem were recently resurveyed for the lower Chehalis River model and the data for the overflow reach will be taken from available LiDAR data.

Survey data collection will be conducted by PGS.

***Projected Sub-Task Completion Date:*** February 22, 2012.

***Sub-Task Budget:*** \$10,200.00

**Task e – Compare cross section geometry and integrate new channel data into model** - The new cross section surveys described in Task d will be graphically compared to the earlier survey data. Comparisons of the channel location as shown on available aerial photographs from the time of the original survey and the current survey will also be prepared. WSE will summarize these comparisons in a brief tech memo and the new channel survey data will be incorporated into the lower Chehalis River model.

Watershed Science & Engineering will conduct the data comparisons and WEST will update the hydraulic model.

***Projected Sub-Task Completion Date:*** March 1, 2012.

***Sub-Task Budget:*** \$7,950.00